Indonesian Journal of Halal Studies (IJHS)
Vol. 3, No. 1, June 2026, pp. 1-12
ISSN: 3089-3631, DOI: https://doi.org/10.18326/ijhs.v3i1.1-12

Exploring the Role of Blockchain Technology in Building Transparency and Traceability in the Halal Food Supply Chain

Himah Naely Rahmah

Universitas Islam Negeri K.H. Abdurrahman Wahid Pekalongan, Indonesia

Article Info

Article history:

Received Nov 04, 2025
Revised May 26, 2026
Accepted June 1, 2026

Keywords:

Blockchain; Transparency, Traceability, Halal Supply Chain, Consumer trust

ABSTRACT

The growing demand for transparency and traceability in the halal food industry has accelerated the adoption of digital technologies to strengthen halal supply chain management. This study aims to examine the potential role of blockchain technology in enhancing transparency, traceability, and consumer trust within Indonesia's halal food supply chain. Employing a qualitative approach through a narrative literature review, this study synthesizes relevant scholarly literature on halal supply chains, blockchain technology, and digital traceability systems. The findings indicate that blockchain can substantially improve the integrity of halal information by providing decentralized, transparent, immutable, and real-time data recording. This capability enables stakeholders to trace products throughout the entire supply chain—from raw material sourcing to final consumption—thereby minimizing data manipulation, counterfeit halal certification, and information asymmetry. In addition, blockchain enhances audit efficiency, strengthens halal governance, and increases consumer confidence while improving the global competitiveness of Indonesia's halal industry. The study contributes to the literature by offering a comprehensive conceptual analysis of blockchain integration into halal supply chain governance within the Indonesian context, where empirical and conceptual discussions remain limited. Despite its considerable potential, blockchain implementation faces several challenges, including inadequate digital infrastructure, limited technological capabilities among stakeholders, high implementation costs, and the absence of standardized regulatory frameworks. Therefore, stronger collaboration among government institutions, halal certification authorities, industry actors, and academic communities is necessary to establish an integrated blockchain ecosystem that supports a more transparent, accountable, and sustainable halal supply chain in Indonesia.

Corresponding Author:

Himah Naely Rahmah
Universitas Islam Negeri K.H. Abdurrahman Wahid Pekalongan, Indonesia.
Email: himahnaelyr@gmail.com

INTRODUCTION

The global halal food industry has undergone a remarkable transformation over the past decade, evolving from a niche religious market into one of the fastest-growing sectors of the global economy. This transformation has been driven not only by the continuous growth of the global Muslim population, which is projected to approach two billion people by 2030 (Anas & Setiawan, 2026), but also by increasing consumer awareness regarding food safety, ethical production, product authenticity, and sustainability. Consequently, halal products are no longer perceived solely as religious commodities intended for Muslim consumers; rather, they have become symbols of quality assurance, hygiene, safety, and responsible production that are increasingly accepted by broader global markets. The halal economy now encompasses diverse sectors, including food and beverages, pharmaceuticals,

cosmetics, tourism, logistics, and financial services, generating an economic value estimated at several trillion US dollars annually. These developments have elevated halal assurance from a purely religious obligation to a strategic economic issue closely linked to international trade, industrial competitiveness, and sustainable development.

The rapid expansion of the global halal industry has transformed halal assurance into a comprehensive supply chain issue rather than merely a matter of product certification. Halal integrity must be maintained throughout the entire production process, from raw material procurement, processing, packaging, storage, transportation, and distribution to final consumption. Consequently, halal assurance should be understood as a continuous process involving multiple stakeholders, including suppliers, manufacturers, logistics providers, certification agencies, retailers, and regulatory authorities. As halal supply chains become increasingly complex and geographically dispersed, maintaining transparency and consistency across every stage has become one of the major challenges facing the contemporary halal industry (Arshad et al., 2018).

At the same time, digital transformation has significantly reshaped supply chain management through the adoption of Industry 4.0 technologies such as artificial intelligence, the Internet of Things (IoT), cloud computing, big data analytics, and blockchain. Among these technologies, blockchain has received considerable attention because it enables decentralized, transparent, immutable, and real-time data management. Unlike conventional centralized databases, blockchain stores transactions in distributed ledgers that are difficult to manipulate, thereby enhancing data integrity, accountability, and trust. These characteristics make blockchain particularly suitable for industries where product authenticity and reliable information are essential, including the halal food sector (Julian et al., 2025).

Indonesia occupies a strategic position in the global halal ecosystem as the country with the world's largest Muslim population and one of the most promising halal producers. Supported by abundant natural resources, a growing food processing industry, and an expanding network of halal-certified micro, small, and medium-sized enterprises (MSMEs), Indonesia possesses significant potential to become a global halal production hub. However, demographic advantages alone are insufficient to ensure international competitiveness. Global consumers and trading partners increasingly demand transparent, accessible, and verifiable information regarding the origin, processing, certification, and distribution of halal products. Therefore, Indonesia must strengthen its halal assurance system by integrating digital technologies capable of improving transparency, accountability, and traceability throughout increasingly complex supply chains (Susanto et al., 2025).

One of the most important challenges in halal supply chain management is the development of an effective traceability system. Traceability refers to the ability to identify, record, and verify product movement and related information from raw materials to final consumers. Within halal systems, traceability serves not only as a technical mechanism for product tracking but also as an instrument for ensuring religious compliance, consumer protection, and supply chain accountability. Effective traceability enables stakeholders to identify potential contamination, verify halal certification, facilitate product recalls, and strengthen consumer confidence by providing reliable information regarding halal status throughout production and distribution (Nazri et al., 2020).

These challenges are particularly relevant in Indonesia, where the halal industry is largely dominated by MSMEs with varying levels of technological capability. Although the implementation of mandatory halal certification has strengthened the national halal assurance system, many businesses continue to rely on paper-based documentation, manual

record-keeping, and fragmented information systems. Such practices reduce operational transparency, prolong verification processes, increase administrative costs, and create opportunities for data inconsistency and fraudulent activities. Furthermore, conventional halal traceability systems remain highly centralized and fragmented, with data stored separately by producers, logistics providers, certification agencies, distributors, and retailers. This fragmentation creates information asymmetry, complicates auditing procedures, and limits the ability of regulators and consumers to verify halal compliance efficiently (Alamsyah et al., 2022).

From the perspective of Islamic principles, halal assurance extends beyond compliance with prohibited ingredients or production methods. The concept of *halalan tayyiban* emphasizes that food should be lawful, safe, hygienic, wholesome, ethically produced, and socially responsible. Consequently, halal governance requires an integrated management system that promotes transparency, accountability, and collaboration among all actors involved in the supply chain. In this context, halal certification represents only one component of a broader governance framework that also depends on continuous monitoring, reliable documentation, and transparent information sharing.

Blockchain technology offers promising solutions to these governance challenges. Through its distributed ledger architecture, blockchain enables every authorized stakeholder to access synchronized and tamper-resistant transaction records. Each transaction is cryptographically verified, time-stamped, and permanently recorded, making subsequent modification extremely difficult. These characteristics provide high levels of transparency, security, traceability, and accountability that address many limitations of conventional information systems. Within halal supply chains, blockchain can create end-to-end visibility by recording product information from raw material procurement to final consumption. Producers, certification agencies, logistics providers, regulators, retailers, and consumers can access consistent and verifiable information regarding product origin, processing history, storage conditions, transportation, and halal certification status. As a result, blockchain reduces information asymmetry, strengthens auditing processes, facilitates regulatory compliance, and enhances consumer trust (Fitriani & Eliza, 2025).

The integration of blockchain also aligns with broader objectives of halal governance by supporting collaboration among multiple institutions responsible for maintaining halal integrity. Rather than replacing existing certification systems, blockchain complements current regulatory mechanisms by improving information transparency, reducing administrative complexity, and supporting evidence-based decision-making. Consequently, blockchain should be viewed not only as a technological innovation but also as a governance mechanism capable of strengthening institutional trust and accountability within halal ecosystems (Wahyuni & Handoko, 2025).

Growing scholarly interest has produced an expanding body of literature examining blockchain applications in supply chain management, logistics, food safety, and digital governance. Existing studies generally acknowledge blockchain's potential to improve traceability, operational efficiency, and information security. Within the halal sector, previous research has mainly focused on technological architecture, food authentication, smart contracts, logistics, and digital certification. While these studies provide valuable insights into blockchain implementation, several important research gaps remain. Most previous studies examine blockchain primarily as a technological solution, paying limited attention to its broader implications for halal governance, institutional accountability, stakeholder collaboration, and consumer trust. In addition, transparency, traceability, certification, and trust are often investigated separately rather than as interconnected dimensions within an integrated halal governance framework. Finally, studies focusing

specifically on Indonesia remain relatively limited despite the country's strategic importance in the global halal market and its ambition to become a leading halal production hub.

This study addresses these gaps by providing an integrated conceptual analysis of blockchain technology as a mechanism for strengthening transparency, traceability, halal governance, and consumer trust within Indonesia's halal food supply chain. Using a narrative literature review approach, the study synthesizes perspectives from halal supply chain management, digital governance, and information systems to explain how blockchain can support a more transparent, accountable, and trustworthy halal ecosystem. The findings contribute theoretically by integrating discussions of blockchain, transparency, traceability, halal governance, and consumer trust into a unified conceptual framework. Practically, the study offers insights for policymakers, halal certification authorities, food manufacturers, logistics providers, and other stakeholders seeking to strengthen digital traceability and improve governance within Indonesia's halal ecosystem while supporting the broader digital transformation of the global halal industry.

METHODS

This study employs a qualitative approach using a narrative literature review to examine the potential role of blockchain technology in enhancing transparency and traceability within the halal food supply chain. A narrative review was selected because it enables a comprehensive synthesis of interdisciplinary literature on halal supply chain management, blockchain technology, and digital traceability.

Relevant literature was collected from academic databases, including Google Scholar, Scopus, and ResearchGate, as well as official reports, regulatory documents, and publications from government and international organizations. The search was conducted using keywords such as *halal supply chain*, *blockchain technology*, *halal traceability*, *food supply chain transparency*, and *halal assurance system*. The review included peer-reviewed journal articles, books, conference proceedings, regulations, and institutional reports published between 2017 and 2025.

The literature selection process consisted of three stages: identification, screening, and relevance assessment. Sources were included if they addressed blockchain applications, halal supply chains, traceability, transparency, or halal assurance systems. Literature lacking academic credibility or relevance to the research objectives was excluded. More than 20 relevant sources were selected for the final analysis.

Data were analyzed using qualitative descriptive analysis through thematic categorization, comparison of findings across studies, and conceptual synthesis. This process enabled the identification of key themes, relationships, and research gaps regarding blockchain adoption in halal supply chain governance. Based on these findings, the study develops a conceptual understanding of how blockchain technology can strengthen transparency, traceability, and consumer trust within Indonesia's halal food supply chain.

RESULT AND DISCUSSION

Halal Supply Chain as the Foundation for Transparency and Traceability

The synthesis of the reviewed literature indicates that the halal supply chain has evolved beyond a conventional logistics system into a comprehensive governance framework that safeguards halal integrity throughout the entire product lifecycle. Rather than focusing solely on the halal status of the final product, the halal supply chain emphasizes continuous compliance with Islamic principles from raw material sourcing, processing, storage, transportation, distribution, and retailing to final consumption (Isnaeni, 2020). This holistic approach ensures that products remain free from prohibited (haram) and doubtful (syubhat) elements at every stage of the supply chain (Lingga & Malahayatie, 2024).

Consequently, halal assurance should be understood as a process-oriented system in which the integrity of every supply chain activity determines the credibility of halal-certified products.

Across the reviewed studies, transparency and traceability consistently emerge as the two fundamental pillars of an effective halal supply chain. Transparency refers to the availability of reliable and verifiable information regarding production activities, while traceability denotes the capability to identify and monitor the movement of products and related information throughout the supply chain (Sawalni & Ridwan, 2025; D. Wahyuni & Arfidhila, 2019). These two dimensions are highly interdependent. Traceability cannot function effectively without transparent information sharing, whereas transparency has limited practical value if product movements cannot be systematically tracked. Therefore, both principles collectively strengthen accountability, facilitate auditing processes, and ensure that halal compliance can be verified throughout the production and distribution network.

The growing importance of transparency and traceability reflects broader changes in the global halal industry. The reviewed literature demonstrates that halal consumers increasingly demand not only certified products but also credible information regarding product origin, production processes, transportation, storage conditions, and certification history. This trend indicates a shift in consumer expectations from label-based trust toward evidence-based trust, where purchasing decisions are supported by accessible and verifiable information rather than by certification labels alone. Such developments are closely associated with the expansion of international halal trade and the increasing complexity of modern food supply chains, which often involve multiple suppliers, manufacturers, logistics providers, distributors, and certification agencies operating across different geographical locations.

The synthesis further suggests that maintaining halal integrity has become increasingly challenging as supply chains become longer and more fragmented. Information is frequently generated and stored independently by different stakeholders, creating fragmented documentation, information asymmetry, and limited coordination across the supply chain. These conditions increase the risks of data inconsistency, fraudulent practices, counterfeit halal certification, and difficulties in verifying compliance throughout production and distribution processes. Consequently, conventional documentation systems that rely heavily on paper-based records and centralized databases are becoming insufficient to support comprehensive halal assurance in increasingly interconnected markets.

These challenges are particularly relevant to Indonesia. As the country with the world's largest Muslim population, Indonesia possesses enormous potential to become a global halal production and export hub. However, realizing this potential requires a halal supply chain system capable of ensuring transparency, accountability, and reliable traceability. The implementation of Law Number 33 of 2014 concerning Halal Product Assurance represents an important regulatory milestone in strengthening halal governance by providing legal certainty, consumer protection, and standardized certification procedures. Nevertheless, the reviewed literature indicates that regulatory compliance alone is insufficient unless supported by an integrated information management system that enables real-time monitoring and verification across the entire supply chain.

The literature also highlights the strategic value of halal supply chains for multiple stakeholders. For consumers, transparent and traceable supply chains enhance confidence by providing verifiable evidence regarding product authenticity and halal compliance. For producers, they improve operational credibility, strengthen brand reputation, and increase competitiveness in international halal markets. For governments and certification

authorities, integrated halal supply chains facilitate monitoring, auditing, and policy implementation while supporting the long-term development of national halal industries (Khazaini et al., 2024). These findings demonstrate that halal supply chains should not merely be regarded as operational logistics systems but as strategic governance mechanisms that integrate religious compliance, consumer protection, food safety, and economic competitiveness.

Overall, the synthesis demonstrates that transparency and traceability constitute the core foundations of halal supply chain governance. However, the reviewed studies consistently acknowledge that achieving these principles through conventional information management systems remains challenging due to fragmented data, manual documentation, and limited interoperability among stakeholders. These limitations create the need for digital technologies capable of providing secure, transparent, and verifiable information management. Within this context, blockchain emerges as a promising technological innovation capable of addressing many of these governance challenges. Accordingly, the following section discusses how blockchain technology strengthens transparency and traceability within halal food supply chains.

Blockchain as an Enabler of Transparency and Traceability in Halal Supply Chains

The synthesis of the reviewed literature demonstrates that blockchain technology has emerged as one of the most promising digital solutions for strengthening transparency and traceability within halal food supply chains. Across the analyzed studies, blockchain is consistently recognized not merely as a digital database but as a decentralized governance mechanism capable of ensuring the integrity, security, and verifiability of information throughout the entire supply chain. These characteristics directly address one of the most persistent challenges in halal assurance systems, namely fragmented information management resulting from lengthy supply chains, manual documentation, and limited coordination among supply chain actors.

The reviewed literature indicates that transparency in halal supply chains extends beyond simple information disclosure. Instead, transparency requires that information related to product origin, production processes, logistics, storage, certification, and distribution be accurate, reliable, and independently verifiable by all authorized stakeholders (Usmi et al., 2024). Conventional information systems frequently rely on centralized databases and paper-based documentation, creating opportunities for data inconsistency, delayed verification, and document manipulation. Such limitations reduce institutional accountability and weaken consumer confidence because halal claims cannot always be verified throughout the production and distribution process.

Blockchain addresses these challenges by providing a decentralized and immutable ledger in which every transaction is permanently recorded, cryptographically secured, and collectively verified by network participants. Rather than storing information within isolated organizational databases, blockchain creates a shared digital environment that enables producers, suppliers, logistics providers, certification agencies, regulators, retailers, and consumers to access synchronized and verifiable information. As a result, every stage of the halal supply chain—from raw material procurement and processing to transportation, storage, retail distribution, and final consumption—can be monitored continuously without compromising data integrity. This capability substantially improves end-to-end visibility while reducing opportunities for unauthorized data modification and fraudulent practices.

A recurring theme identified across the reviewed studies is the role of blockchain in enhancing halal traceability. Unlike conventional tracking systems, blockchain enables complete documentation of product histories through permanent digital records that remain

accessible throughout the product lifecycle. This capability allows regulators and certification authorities to verify compliance more efficiently, facilitates product recalls when necessary, and enables consumers to trace the origin and movement of halal products in real time. Several studies further suggest that blockchain-based traceability can be integrated with Quick Response (QR) codes or mobile applications, allowing consumers to instantly access information regarding raw materials, production facilities, halal certification, logistics history, and distribution channels. Consequently, consumer trust is no longer based solely on the presence of a halal logo but is reinforced through transparent and verifiable digital evidence (Purwati et al., 2026).

The synthesis also reveals that blockchain contributes significantly to improving institutional efficiency within halal governance. For producers and food manufacturers, blockchain simplifies documentation processes, reduces administrative burdens, and facilitates compliance with halal certification requirements. Because production records are digitally stored and continuously updated, halal audits can be conducted more efficiently, reducing both verification time and operational costs (Wikantara et al., 2026). Similarly, certification authorities and government institutions benefit from improved monitoring capabilities, as blockchain provides real-time access to verified supply chain information that supports regulatory enforcement and evidence-based decision-making (Lisdayanti & Padmanegara, 2024). These findings indicate that blockchain contributes not only to operational efficiency but also to strengthening institutional accountability within halal certification systems.

More importantly, the reviewed literature consistently emphasizes that blockchain should be understood as a trust-enabling technology rather than merely an information management tool. Transparency generated through blockchain creates a digital trust environment in which all stakeholders rely on the same verified information without depending exclusively on centralized control mechanisms. This transformation is particularly important for halal industries, where consumer confidence is closely associated with the credibility of certification systems and the integrity of production processes. The findings therefore suggest that blockchain strengthens halal governance by integrating transparency, traceability, accountability, and stakeholder collaboration into a unified digital ecosystem.

Nevertheless, the literature also highlights that blockchain is not a universal solution capable of addressing all challenges within halal supply chains. Successful implementation depends on several enabling factors, including adequate digital infrastructure, interoperability between information systems, supportive regulatory frameworks, institutional collaboration, and the technological readiness of industry stakeholders, particularly micro, small, and medium-sized enterprises (MSMEs). Without these supporting conditions, the benefits of blockchain may not be fully realized. Consequently, blockchain adoption should be viewed as part of a broader digital transformation strategy aimed at strengthening halal governance rather than as a standalone technological intervention.

Overall, the synthesis confirms that blockchain possesses considerable potential to transform halal supply chain management by improving transparency, strengthening traceability, enhancing institutional accountability, and fostering consumer trust. However, realizing these benefits requires coordinated efforts among governments, certification bodies, industry actors, and technology providers to establish an integrated digital ecosystem capable of supporting sustainable halal governance. Building upon these findings, the following section discusses the opportunities and challenges of implementing blockchain technology within Indonesia's halal food supply chain.

Blockchain Adoption in Indonesia's Halal Supply Chain: Opportunities and Challenges

The synthesis of the reviewed literature suggests that Indonesia possesses substantial potential for implementing blockchain technology within its halal food supply chain. As the country with the world's largest Muslim population, Indonesia represents not only the largest halal consumer market but also one of the most promising global halal production hubs. The rapid expansion of halal industries, supported by mandatory halal certification and increasing international demand for halal products, has created an urgent need for digital governance systems capable of ensuring transparency, traceability, and institutional accountability throughout increasingly complex supply chains. Consequently, blockchain adoption should be viewed not merely as a technological innovation but as a strategic instrument for strengthening Indonesia's national halal ecosystem.

Indonesia's regulatory environment provides a favorable foundation for blockchain implementation. Law Number 33 of 2014 concerning Halal Product Assurance (JPH) establishes mandatory halal certification while emphasizing legal certainty, consumer protection, and accountability within halal governance. The reviewed literature indicates that blockchain can complement this regulatory framework by providing immutable digital records covering raw material sourcing, production activities, logistics, storage, distribution, and certification history. Such capabilities enable certification authorities, including BPJPH and related halal institutions, to conduct monitoring and compliance verification more efficiently through continuous access to reliable and verifiable information. Consequently, blockchain has the potential to strengthen regulatory enforcement while increasing public confidence in Indonesia's halal certification system.

Another significant opportunity identified across the reviewed studies relates to Indonesia's ambition to strengthen its position within the global halal economy. International halal markets increasingly demand not only certified halal products but also credible evidence regarding product authenticity, production processes, and supply chain integrity. Several halal-producing countries, including Malaysia and the United Arab Emirates, have accelerated the adoption of digital technologies to improve halal certification and supply chain management. The literature therefore suggests that integrating blockchain into Indonesia's halal supply chain could enhance export competitiveness by providing internationally recognized digital traceability systems capable of verifying product authenticity throughout the entire production process (Nurdin & Komarudin, 2024). Such digital verification mechanisms may reduce information asymmetry between exporters, regulators, and overseas consumers while strengthening Indonesia's reputation as a reliable supplier of halal products.

The reviewed literature also highlights blockchain's considerable potential for empowering micro, small, and medium-sized enterprises (MSMEs), which constitute the backbone of Indonesia's halal industry. Many halal food producers—particularly those engaged in forest-based commodities such as honey, coffee, spices, medicinal herbs, and other agricultural products—operate in rural areas where documentation practices remain largely manual and fragmented. These limitations often restrict market access because small producers experience difficulties demonstrating compliance with increasingly demanding halal certification requirements. Blockchain offers an opportunity to digitally document production activities, product origins, and distribution histories, thereby improving credibility, facilitating certification processes, and expanding access to both domestic and international halal markets. In this respect, blockchain contributes not only to supply chain

transparency but also to inclusive economic development by strengthening the participation of rural producers within global halal value chains.

Another important finding emerging from the literature concerns the efficiency of halal auditing and certification. Conventional halal audits frequently require substantial administrative effort because supporting documents are collected from multiple organizations using separate information systems. Blockchain enables real-time access to synchronized supply chain records, allowing auditors and certification bodies to verify compliance more efficiently while reducing duplication of documentation and administrative delays (Lisdayanti & Padmanegara, 2024). The reviewed studies therefore suggest that blockchain can improve both the effectiveness and efficiency of halal governance by supporting faster certification processes, enhancing institutional coordination, and reducing operational costs for both regulators and business actors.

Despite these considerable opportunities, the synthesis also reveals several structural challenges that may hinder blockchain adoption in Indonesia. Limited digital infrastructure, particularly in rural production areas, remains a significant obstacle to widespread implementation. Furthermore, many MSMEs continue to experience financial constraints, limited digital literacy, and insufficient technical capacity to adopt blockchain-based information systems. Additional challenges include the absence of standardized interoperability between institutional databases, uncertainty regarding data governance, and the need for harmonized regulations that support digital integration across the halal certification ecosystem. These findings indicate that technological innovation alone cannot guarantee successful implementation without complementary institutional reforms and capacity-building initiatives.

Overall, the reviewed literature demonstrates that blockchain possesses considerable potential to strengthen Indonesia's halal supply chain by improving transparency, traceability, regulatory compliance, consumer trust, and international competitiveness. Nevertheless, successful implementation requires a comprehensive digital transformation strategy involving government agencies, halal certification authorities, technology providers, academic institutions, and industry stakeholders. Rather than adopting a one-size-fits-all approach, Indonesia requires an adaptive blockchain implementation model that accommodates the characteristics of its halal industry, particularly the dominance of MSMEs and geographically dispersed supply chains. Such an approach would enable blockchain to function not merely as a digital technology but as an integrated governance mechanism supporting the long-term development of a transparent, accountable, and globally competitive halal ecosystem.

Implications of Blockchain for Halal Governance and Stakeholder Value

The synthesis of the reviewed literature indicates that the adoption of blockchain technology generates multidimensional value across the halal ecosystem, extending beyond operational improvements in supply chain management. Rather than functioning solely as a digital information system, blockchain contributes to strengthening halal governance by enhancing transparency, accountability, regulatory compliance, and stakeholder trust. These benefits are experienced by consumers, producers, certification authorities, and governments, highlighting blockchain's strategic role in supporting the sustainable development of Indonesia's halal industry.

For consumers, blockchain significantly enhances confidence in halal products by providing transparent and verifiable access to product information throughout the supply chain. The reviewed literature consistently demonstrates that blockchain-based traceability allows consumers to verify the origin of raw materials, production facilities, halal certification status, logistics history, and distribution channels through digital platforms such

as Quick Response (QR) codes or mobile applications (Nuroniyah et al., 2025). Consequently, consumer trust shifts from being primarily label-based to evidence-based, where purchasing decisions are supported by immutable digital records rather than relying exclusively on printed halal logos. This transformation not only increases transparency but also empowers consumers to make more informed purchasing decisions while encouraging greater accountability among halal producers.

From the producers' perspective, blockchain strengthens organizational credibility and improves competitiveness within both domestic and international halal markets. The literature suggests that blockchain enables food manufacturers to demonstrate compliance with halal standards through comprehensive digital documentation covering every stage of production and distribution. Such transparency enhances corporate reputation, facilitates market access, and increases buyer confidence, particularly in export-oriented industries where product authenticity and traceability have become essential market requirements. Furthermore, blockchain improves operational efficiency by reducing documentation redundancy, simplifying halal audit procedures, and facilitating compliance with certification requirements. These advantages are particularly valuable for Indonesian micro, small, and medium-sized enterprises (MSMEs), enabling them to improve market credibility despite operating with relatively limited organizational resources.

The reviewed studies also emphasize the significant institutional benefits generated by blockchain adoption. For government agencies, halal certification authorities, and independent auditors, blockchain provides a reliable digital infrastructure that supports continuous monitoring, evidence-based auditing, and more effective regulatory enforcement (Nurkholidah, 2025). Real-time access to verified supply chain information enables certification bodies such as BPJPH and other relevant institutions to improve audit efficiency, accelerate certification procedures, and strengthen oversight of halal compliance throughout increasingly complex production networks. In addition, blockchain-generated data provide valuable insights for policymakers by facilitating risk identification, supply chain mapping, and strategic planning for the long-term development of Indonesia's halal industry (Azwar et al., 2025).

Beyond national governance, blockchain also contributes to strengthening Indonesia's position within the global halal economy. International consumers and trading partners increasingly demand transparent evidence regarding product authenticity, ethical production, and supply chain integrity. Blockchain-based traceability systems provide internationally verifiable records that enhance the credibility of Indonesian halal products while reducing information asymmetry between exporters, certification authorities, importers, and consumers. Consequently, blockchain supports Indonesia's broader ambition to become a leading global halal producer by reinforcing international trust, improving export competitiveness, and facilitating participation in increasingly digitalized halal markets.

Despite these significant advantages, the reviewed literature consistently emphasizes that blockchain should not be viewed merely as a technological innovation but as an enabling mechanism for digital transformation within halal governance. The successful realization of its benefits depends upon institutional collaboration, regulatory harmonization, digital infrastructure, technological readiness, and stakeholder commitment. Without these complementary conditions, blockchain alone cannot fully address governance challenges within complex halal supply chains.

Overall, the synthesis demonstrates that blockchain creates value simultaneously across technological, institutional, economic, and social dimensions. By integrating

transparency, traceability, accountability, and stakeholder collaboration into a unified digital ecosystem, blockchain strengthens consumer protection, enhances regulatory effectiveness, improves business competitiveness, and reinforces the credibility of Indonesia's halal industry. These findings further support the proposition that blockchain should be regarded as a strategic governance innovation capable of facilitating the long-term transformation of sustainable and globally competitive halal supply chains.

CONCLUSION

This study concludes that blockchain technology has significant potential to strengthen transparency, traceability, and governance within Indonesia's halal food supply chain by providing decentralized, immutable, and verifiable records throughout the production and distribution process. The synthesis of the reviewed literature demonstrates that blockchain not only enhances consumer trust through transparent halal information but also improves audit efficiency, regulatory compliance, and the global competitiveness of halal products, while supporting the implementation of Indonesia's Halal Product Assurance Law and the digital transformation of the national halal industry. Nevertheless, successful adoption depends on overcoming key challenges, including limited digital infrastructure, low technological readiness among MSMEs, high implementation costs, and the need for interoperable regulatory frameworks through collaboration among government agencies, certification authorities, industry stakeholders, and academia. As this study is based on a narrative literature review, future research should validate the proposed conceptual framework through empirical investigations across various halal sectors, including MSMEs, forest-based products, and digital halal ecosystems, to better understand the practical effectiveness and governance implications of blockchain implementation.

REFERENCES

Alamsyah, A., Hakim, N., & Hendayani, R. (2022). Blockchain-Based Traceability System to Support the Indonesian Halal Supply Chain Ecosystem. *Economies*, *10*(134), 1–18. https://doi.org/10.3390/ economies10060134

Anas, Z., & Setiawan, M. A. (2026). Analisis Potensi Dan Peluang Industri Halal Presidensi G-20 Terhadap Peningkatan Awareness Ekonomi Dan Keuangan Syariah Indonesia. *Jurnal Al-Iqtisodiyah: Jurnal Ilmu Ekonomi Dan Ekonomi Islam*, *2*(1), 13–22.

Arshad, R., Bakar, C. A. A., & Ramli, Z. A. (2018). Capturing the Halal Food Market : Limitations of Halal Integrity within the Supply Chain , the Malaysian Experience. *American Journal of Economics*, *8*(6), 272–278. https://doi.org/10.5923/j.economics.20180806.06

Azwar, A., Mulyawan, A. W., & Siradjuddin, S. (2025). Ekonomi Halal Perkotaan 5.0: Inovasi Kolaboratif untuk Pengembangan Industri Halal Berkelanjutan di Indonesia. *Al-Qiblah: Jurnal Studi Islam Dan Bahasa Arab*, *4*(6), 782–811. https://doi.org/10.36701/qiblah.v4i6.2668

Fitriani, N. N., & Eliza, Z. (2025). Review article : Blockchain as an innovative solution for halal verification of food products in global supply chains. *Journal of Halal Science and Research (JHSR)*, *6*(2), 186–196. https://doi.org/10.12928/jhsr.v6i2.12022

Isnaeni, A. (2020). *mplementasi Halal Supply Chain Management Pada Industri Pengolahan Makanan (Studi Kasus : Restoran Taman Pringsewu Yogyakarta)*. Universitas Islam Indonesia.

Julian, F. A., Rachmayani, N., & Aufi, I. (2025). Blockchain and AI Integration in Halal Supply Chains : Toward a Trusted Digital Ecosystem. *Journal of Artificial Intelligence*

and Digital Business (RIGGS), *4*(3), 3229–3238.

Khazaini, W., Munir, M., & Ahmadiono, A. (2024). Peningkatan kinerja perusahaan melalui implementasi strategi manajemen halal supply chain. *JIS: Jurnal Ilmu Sosial*, *4*(1), 48–67. https://ejournal.penerbitjurnal.com/index.php/socialscience/article/view/765

Lingga, N., & Malahayatie, M. (2024). Konsep Halal Haram dalam Ekonomi Islam. *Jurnal Ekonomi Dan Bisnis Islam*, *3*(2), 101–116. https://doi.org/10.57210/j-ebi.v3i02.307

Lisdayanti, A., & Padmanegara, O. H. (2024). Peran Teknologi Blockchain dalam Meningkatkan Kepercayaan Konsumen dan Keamanan Data Privasi pada Platform E-Commerce di Indonesia. *Jurnal Manajemen Bisnis Dan Keuangan*, *5*(2), 347–361. https://doi.org/10.51805/jmbk.v5i2.245 Peran

Nazri, N. N., Sahari, N. H., & Nor, A. M. (2020). Challenges In The Adoption Of A Traceability System In The Halal Food Supply Chain In Malaysia. *International Journal of Advanced Research (IJAR)*, *12*(4), 178–188. https://doi.org/10.21474/IJAR01/18537

Nurdin, I. B., & Komarudin, K. (2024). Pemanfaatan teknologi blockchain untuk meningkatkan kualitas keterjaminan halal pada produk makanan dan minuman di indonesia. *Ad-Deenar: Jurnal Ekonomi Dan Bisnis Islam*, *8*(1), 95–104. https://doi.org/10.30868/ad.v8i01.6469

Nurkholidah, S. (2025). Peluang dan Tantangan Penerapan Blockchan pada Produk Halal di Indonesia. *Maliyah: Jurnal Hukum Bisnis Islam*, *15*(2), 252–270.

Nuroniyah, L., Nawaliyah, N., Ja'far, M., Aminulloh, M., & Gazani, H. (2025). Peran inovasi dan teknologi dalam meningkatkan daya saing industri halal global. *JURNAL MEDIA AKADEMIK (JMA)*, *3*(12), 1–10. https://doi.org/10.62281/gp6wp555

Purwati, D., Melinasari, S., & Kartono, K. (2026). Inovasi Teknologi dalam Industri Halal Dalam Meningkatkan Keamanan Rantai Pasok Indutri Halal Internasional. *Jurnal Kajian Islam Modern*, *14*(1), 30–40. https://doi.org/10.56406/jkim.v14i01.1000

Sawalni, S., & Ridwan, A. H. (2025). Transparansi Kehalalan Produk Makanan dan Minuman dalam Platform E-Commerce: Telaah Tafsir Al-Misbah terhadap Aplikasi Shopeefood dan Gofood. *Equality: Journal of Islamic Law (EJIL)*, *3*(1), 1–12. https://doi.org/10.15575/ejil.v3i1.1007

Susanto, D., Sapa, N., & Muthiadin, C. (2025). Teknologi Dalam Penjamin Produk Halal. *Jurnal Studi Ekonomi Dan Bisnis Islam (SEBI)*, *7*(2), 107–117.

Wahyuni, D., & Arfidhila, N. (2019). Traceability pada Rantai Pasok Pangan Halal : Review Literatur. *TALENTA Conference Series: Energy & Engineering*, *2*(4), 38–45. https://doi.org/10.32734/ee.v2i4.649

Wahyuni, T., & Handoko, L. H. (2025). Implementing Blockchain Technology in Halal Certification: A Systematic Literature Review of Opportunities and Challenges. *Al-Falah : Journal of Islamic Economics*, *10*(2), 193–212. https://doi.org/10.29240/alfalah.v10i2.14669

Wikantara, I. W. A., Gara, G. P. W., Putra, I. G. A. M., Dananjaya, I. G. N. A., Priantara, I. K. T. A. D., Febrianty, P. A. T., & Billyantari, W. P. (2026). *Implementation Blockchain For Sustainable*. CV HEI PUBLISHING INDONESIA.